

Book No 13

BOARD OF TECHNICAL EDUCATION
M. P. BHOPAL

13/0

3 Years Diploma Course In Chemical Engineering

SYLLABUS FOR SECOND YEAR

REVISED IN 1995

M.P. BOARD OF TECHNICAL EDUCATION BHOPAL.

13/11

II YEAR/III SEMESTER DIPLOMA PROGRAMME IN CHEMICAL ENGG. (REVISED CURRICULUM)

[To be introduced in 1995-96 at GOVERNMENT POLYTECHNIC, UJJAIN]

| S. No. | NAME OF SUBJECT | SCHEME OF STUDY | | SCHEME OF EXAMINATION | | | | | Kd MA Ks S | | | | | |
|--------|--------------------------------------|-----------------------------|---------|------------------------|----------|-------------------|----|-------|---------------------|---------------------------|------------------------|-----------------------|------|-----|
| | | CONTACT HRS PER WEEK [YEAR] | | SESS. MKS. PROG. ASSM. | | BOARD EXAMINATION | | | | | | | | |
| | | THEORY | LAB. | TERM WORK | LAB WORK | I | II | PAPER | | TH. DURA- TION hrs. | PRAC- TICAL MKS. | DURA- TION hrs. | MKS. | |
| 1. | Process Calculations | 06(96) | -- | 06(96) | 20 | -- | 10 | 10 | 01 | 3 | 100 | -- | -- | -- |
| 2. | Communication Skill | 06(96) | -- | 06(96) | 20 | -- | 10 | 10 | 01 | 3 | 100 | -- | -- | -- |
| 3. | Engg. Mathematics | 06(96) | -- | 06(96) | 20 | -- | 10 | 10 | 01 | 3 | 100 | -- | -- | -- |
| 4. | Elect. Engg. & Electronics | 05(80) | 04(64) | 09(144) | 20 | 25 | 10 | 10 | 01 | 3 | 100 | 01 | 3 | 50 |
| 5. | Applied Physical & Organic Chemistry | 05(80) | 04(64) | 09(144) | 20 | 25 | 10 | 10 | 01 | 3 | 100 | 01 | 3 | 50 |
| TOTAL | | 28(448) | 08(128) | 36(576) | 100 | 50 | 50 | 50 | 05 | 05 | 500 | 02 | 02 | 100 |

(A) Theory 33%
 (B) Practicals 40%
 (C) Sessionals 60%
 (D) Inplant Training 50%

- NOTE :
- No. of theory paper : 05
 - Total theory marks : 500
 - No. of Practicals : 02
 - Total Pr. Marks : 100
 - Inplant Training Mks -
 - Total Marks of Sessional, Prog. Assm. 250
 - Ratio of Theory Marks 10 :: 07 & (Sess.+Prog. Assm.+ Practical Marks) 850
 - Total Marks
 - Passing Marks for -

M.P. BOARD OF TECHNICAL EDUCATION BHOPAL.

II YEAR/IV SEMESTER DIPLOMA PROGRAMME IN CHEMICAL ENGG. (REVISED CURRICULUM)
(To be introduced in 1995-96 at GOVERNMENT POLYTECHNIC, UJJAIN.)

| S. NO. | NAME OF SUBJECT | SCHEME OF STUDY | | SCHEME OF EXAMINATION | | | | | | | TOTAL | | | |
|--------|---|-----------------------------|---------|-----------------------|----------|-------|-------|-------------------|---------------|------------|-------|----------------|----|-----|
| | | CONTACT HRS PER WEEK [YEAR] | TOTAL | TERM WORK | LAB WORK | I | II | TH. PAPER | DURATION HRS. | PRAC-TICAL | | DURA-TION HRS. | | |
| | | THEORY | LAB. | WORK | WORK | ASSM. | PROG. | BOARD EXAMINATION | | | MA | SS | | |
| | | | | | | | | | | | | | | |
| 1. | Mfg. Process & Practice | 04(64) | 03(48) | 07(112) | 20 | 25 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |
| 2. | Equipment Drawing | 02(32) | 04(64) | 06(96) | 20 | -- | 10 | 10 | 1 | 3 | 100 | -- | -- | -- |
| 3. | Mechanical Operations in Chemical Engineering | 05(80) | 04(64) | 09(144) | 20 | 25 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 100 |
| 4. | Chemical Process Tech.-I | 04(64) | 04(64) | 08(128) | 20 | 25 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |
| 5. | Material Technology | 04(64) | 02(32) | 06(96) | 20 | 25 | 10 | 10 | 1 | 3 | 100 | 1 | 3 | 50 |
| TOTAL | | 19(304) | 17(272) | 36(576) | 100 | 100 | 50 | 50 | 05 | 04 | 500 | 04 | 04 | 250 |

- NOTE :
- No. of Theory Papers : 05
 - Total Theory Marks : 500
 - No. of Practical : 04
 - Total Practical Marks : 250
 - Inplant Training Marks : --
 - Total Marks of Sessional, Prog.Assm., Pract. & Inplant Training. : 300
 - Ratio of Theory Marks and (Sess.+Prog.Assm.+ Practical + Inplant Training i.e. Marks. : 10 :: 11
 - Total Marks : 1050
 - Passing marks for : --
- (A) Theory 33%
- (B) Practicals 40%
- (C) Sessionals 60%
- (D) Inplant Training 50%

1978

13/3

:: CHEMICAL PROCESS CALCULATION ::

RATIONALE :-

This is a core subject for all chemical Engg. studies must have to include this course in its curriculum. This course deals with the quantitative aspect of the practical applications of the principles of physical Chemistry to the solution of complex industrial problems and constitutes the very basis of all engineering design for Chemical Processes.

UNIT - I

Basic and derived Units, Different ways of expressing units of quantities and physical constants.

Molar Concept : Inter-relationship between mass and volumetric compositions of mixtures and solutions.

UNIT - II

Behaviour of Ideal and real gases: Boyle's law, Charles's law, Avogadro's Hypothesis, Dalton's law, Amagat's law, vapor pressure, humidity, relative humidity, percentage humidity, dew point and use of humidity chart.

UNIT - III

Material balance : Stoichiometric relations governing chemical reactions, concept of limiting and excess reactants, tie and key components, percentage conversion and degree of completion, Simple recycle, bypass and purging operations. Material balance calculations of some common processes

UNIT - IV

Energy balance :

(A) Thermophysics : Heat capacity of solids, liquids, gases and solutions simple energy balance for gaseous and gas-liquid, liquid-liquid systems.

(B) Thermochemistry : Heat of formation, heat of combustion, heat of reaction and laws of thermochemistry. Energy balance calculations of common chemical processes.

UNIT - V

Fuels and combustion. Types of fuels, calorific values of fuel, and combustion calculations.

TEXT/REFERENCE

BOOKS :-

1. Chemical Process Principle by -
Hougen and Watson.
2. Stoichiometry by -
Bhatt and Vohra.
3. Chemical Process Calculation by -
Hemalblau.
4. Chemical Process Calculation by -
Chemical Engg. Edu. Development Centre, IIT
Madras.

1. Applied Grammar :
 - (A) Determiners.
 - (B) Tenses.
 - (C) Sequence of Sentences.
 - (D) Introduction to verbs -
 - [i] Negative, Interrogative forms and uses.
 - [ii] List of Auxillary verbs used in short answer. In the construction so/neither/nor Aux. subject Use of shall and will. Can used to express ability. Would used to state hypothetical situations.
 - (E) The passive voice :
 - [i] Use
 - [ii] A table of active tenses & their passive equivalents.
 - (F) Verb subject - Verb Agreement.
 - (G) Prepositions.
2. (A) Passages from physical sciences :
 - (i) Tapping the Atom
 - (ii) Radar and its uses.
 - (iii) The Indian Satellite Common Programmes.
 - (iv) A Volcano.
 - (v) Lasers.
- (B) Passages from General Studies :
 - (i) Salient features of the Indian Constitution
 - (ii) Structure of Government.
 - (iii) Functioning of Economic system.
 - (iv) Production & Productivity.
 - (v) Professional Ethics.

3. Technical Writing :

- (i) Its importance.
- (ii) Features of Technical Style.
- (iii) Style literary and Technical.
- (iv) Mechanics of Technical Writing - abbreviations, numerals punctuations and spelling rules.
- (V) Various forms of Technical Writing : Feasibility reports, progress reports trouble reports in the forms of
- (vi) types of business letters.

TEXT REFERENCE BOOKS :

- 1. A course in Technical English, Book - I.
- 2. A course in Technical English Book - II.
(Somoya Pub., BOMBAY).
- 3. Passages in General Studies, Vikas Publication, Bhopal.

RATIONAL :

The syllabus of Engineering Mathematics for IInd Year Diploma consist of 6 units. Each unit has theory and tutorial periods. The marks allotted to each unit 20. The paper covers all the relevant sub-topics which are necessary to the IInd Year Polytechnic students, looking to their cognitive level.

UNIT - I ALGEBRA

- | | | |
|-----|-----------------------------|---|
| 1.1 | Arthmatic Progression | nth. term, sum of n terms, |
| | Geometrical Progression | n' means between two n numbers |
| | Harmonic Progression | $\sum n$, $\sum n^2$ $\sum n^3$ and application of A.P., G.P. and H.P. in engineering. |
| 1.2 | Permutation and Combination | Concept of meaning of npr and ncr relation between npr and ncr permutation of repeated elements. |
| 1.3 | Binomal Theorem | Expnsion of $(X+a)^n$ (without proof) general term, special terms, middle term, independent term, greatest term, binomal of any index (without proof) general term, special term, binomeal cofficeints. |

- 1.4 Exponential and Logarithmic Series infinite series for e
proof of $2 < e < 3$ expansion of e^x , $\log(1+x)$, $\log(1-x)$, $\log \frac{1+x}{1-x}$ etc. use of these series for engineering problems
- 1.5 Partial fraction
- 1.6 Theory of probability Random experiments, sample space event sure event, impossible events mutually exclusive events elementary events equally likely events, addition for mutually exclusive event and non mutually exclusive events.

Conditional probability independent, dependent event multiplication rules for independent and dependent events, binomial Distribution, example application of binomial Distribution, for random experiments.

UNIT - II DIFFERENTIAL CALCULUS

- 2.1 Successive Differentiation Concept of second order and higher order derivatives.

concepts of Leibnitz theorem.
Application of successive differentiation.

| | | |
|-----|--------------------------------------|---|
| 2.2 | Partial Differentiation | Partial derivatives, Differentials Eulers Theromes. |
| 2.3 | Application of Differential Calculus | Geometrical and physical meaning of Differential coefficients. Equation of tangents, normals, sub-tangent, sub-normals, length of tengents and length of normals. |
| 2.4 | Maxima and Minima | Meaning, concepts rules to find maxima and minima problem based from single variables. |
| 2.5 | Radials of Curvature | Meaning of radius of curvature to find the radius of curvature and curvature by cartesion formula. |
| 2.6 | Errors and Approximations | Error, relativ, absolute error, percantage error. (Simple problems only) |

UNIT - III INTEGRAL CALCULUS

- 3.1 Reduction Formula $\int \sin^n x dx, \int \cos^n x dx$
 $\int \tan^n x dx$
- 3.2 Gamma Function Evaluation of $\int \sin^m x \cos^n x dx$
- 3.3 Definite integral Definition, properties and evaluation.
- 3.4 Application of integral calculus Area, volumes, length of arc area under curve, expressed as definite integral for conic sections that is line, circle ellipse, parabola, hyperbola.
- 3.5 Application of integral Calculus for physical quantities Application of integral calculus for work done by a force, work done in expanding gas, work done in stretching an elastic string, centre of gravity and moment of inertia.
- 3.6 Mean value and Root mean square value and Simpson's rule Rules and their application for problems.

UNIT - IV DIFFERENTIAL CALCULUS

- 4.1 Differential equation of first order and first degree
- (a) Variable separable
(b) Homogeneous equation
(c) Linear equation with engineering application.
- 4.2 Differential equation with constant coefficients
- operator D, A, E, C, F and Short cut method to find of type $\frac{1}{f(D)^2} e^{ax}$, $\frac{1}{f(D^2)} \sin$
 $\frac{1}{f(D^2)} \cos ax$, $\frac{1}{f(D)} x^m$
 $\frac{1}{f(D)} x^v$, $\frac{1}{f(D)} e^{ax} v$
- 4.3 Laplace Transformation
- Laplace transformation and simple application for engineering problems.

- 5.1 System of Coordinates Rectangular Cartesian coordinates, position of a point, Distance between two points, section of joining two points, centroid of triangle, centroid of a tetrahedron.
- 5.2 Direction-Cosines and Projections Direction Cosines of a line, coordinate axes, direction ratios, distance of line joining the points, projection of a line on another line, the angle between two lines.
- 5.3 The planes General equation of a plane, equation of a plane through a point, normal form and intercept form of a plane, angle between two planes, to find equation of a plane, distance of a point from the plane, distance between two parallel planes.
- 5.4 The straight lines Equation of a line, symmetric form of the equation of a line. Line through two points, Transformation from general form to symmetric form.
- 5.5 Plane and line Condition of perpendicularity and parallelism, condition for the line to line on the plane.

UNIT - VI MATRICES AND SIMULTANEOUS EQUATION OF SPECIAL TYPES
OF THREE VARIABLES

- | | |
|--|--|
| 6.1 Introduction to matrix and characteristics | Matrix as a rectangular arrangements of numbers, types of matrices, unit matrix, null matrix, row-matrix diagonal matrix, upper triangular matrix, lower triangular matrix, diagonal matrix, scalar matrix, multiplication of scale to matrix. |
| 6.2 Addition and multiplication of matrix | Addition of matrices commutative; associative, distributive, law of scalar multiplication over addition, additive inverse and additive identity, multiplication action of two matrices and its algebraic properties. |
| 6.3 Adjoint, Transpose and inverse matrix for solving simple equations of three variable | Transpose, adjoint and inverse matrix and there algebraic properties application of matrix for solving simultaneous equations of three variable. |
| 6.4 Simultaneous equations of special type of three variables | Harder simultaneous equations of three variable (without use of matrix) |

13/1A

BOOKS RECOMMENDED

1. Higher Algebra by- Hall & Knight
2. Algebra by - Ray & Sharma
3. Calculus Differential by - Gorakh Prasad
4. Integral Calculus by - Gorakh Prasad
5. Three Dimensional Geometry by - R.J. T. Bell
6. Mathematics for Polytechnic Part-I&II By T.T.T.I., Bhopal.
7. Differential Equations By N. Ray
8. Engineering Maths & Computer Application by - Dr. L.P. Gautam and Dr. M. Kumar
9. Applied Mathematics Part - I & II (Hindi) By - Dr. L.P. Gautam
10. Engg. Mathematics By - Dr. S.K. Chouksey & Manoj Singh

#####

RATIONALE:

This again is one of the general core subjects common to certain branches of Engineering. A Diploma Engineer of a Chemical Unit, apart from attending to his own specialized job, may have to deal with equipments and plant operations involving an understanding of the basic electrical and electronics circuits, performance, testing and maintenance of a variety of electrical machines. It is also expected of him that he would be able to carry out some important measurements and understand various industrial process control schemes involving instruments and ,electronic circuits that are relevant to another paper under the title : INSTRUMENTATION & PROCESS CONTROL.

UNIT - I

D.C. Circuits and D.C. Machines

- (A) Review of concepts of Electrical Engg. voltage, current, power, resistance, D.C. Circuit, Kirchoff's law and Ohm's law.
- (B) Constructional feature of D.C.m/c, Armature winding and E.M.F. equation.
- (C) D.C. Motors and their load characteristics, series, shunt, compound.
- (D) Different types of starters, methods of speed control of D.C. Motors.

UNIT-II

13/16

- (A) A.C. Circuits : Alternating current, wave forms, Rms, average value, form factor, power factor, R, L and C in A.C. circuit, 3 phase A.C. star and delta connections, different types of A.C. supply used in common industrial application i.e. 1 phase, 3 phase-3 wire and 3 phase - 4 wire.
- (B) Transformers: Principle of operation of emf equation, transformation ratio, construction detail.

UNIT - III

3 phase A.C. Machines : construction features of induction motors, cage type and slipping type : principles of operation of 3 phase induction motor, slip and slip frequency, application of induction motor. Working principle of single phase induction motor. Synchronous motor and Alternator : Construction feature, principle and application.

UNIT - IV

Electrical measuring instruments : main feature, circuit connections and uses of Ammeter, Voltmeter, Wattmeter and Multimeter, Working principles of M.I. and M.C. type instruments.

UNIT - V

13/17

Electronics: Semi conductor devices, Diode, transistor SCR, Rectifier circuit, H.W. and F.W., filters in power supply circuits, Amplifier action of transistor.

EXPERIMENTS :

1. Study of D.C. m/c.
2. ~~Speed control~~ of D.C. Motors.
3. Study of D.C. motor starters.
4. Performance of RLC series and parallel circuits.
5. Star and delta connection - verification of phase and line voltage and current.
6. Determination of transformation ratio.
7. Determination of efficiency of a single phase transformer by C.C. and S.C. tests.
8. Study and operation of 3 phase squirrel cage and slip ring induction motors.
9. study and operation of starters for induction motors.
10. Study and operation of single phase induction motors.
11. Study and mode of connection of different types of measuring instruments.
12. Measurement of power and energy in a single phase circuit.

- 13. Measurement of power and energy in a 3 phase circuit by 2 wattmeter method.
- 14. Study of various electronic devices such as diodes, transistors, FET, SCR etc.
- 15. Study of rectifiers and observation of wave form on CRC.
- 16. Study of battery charging circuits.

TEXT/REFERENCE BOOKS :

- 1. Electrical Engg. & Electronics by B.L. Theraja.
- 2. Electrical Measurements by J.B. Gupta -
(Dhanpat Rai and Sons Pub.)
- 3. Elementary Electrical Engg. by H. Partab -
(Dhanpat Rai and Sons Pub.)
- 4. Electrical Engg. by S.I. Uppal -
(Khanna Pub.)



13/19

:: APPLIED PHYSICAL AND ORGANIC CHEMISTRY ::

RATIONALE :

This course which deals with organic chemistry in a greater detail and some advanced topics on physical chemistry to which the students have no prior exposure is meant for providing a solid base for understand the technology of chemical operations that are to be covered through other papers.

UNIT - I

(A) Phase Rule : statement and explanation, Derivation, one component system - water, Two component system - KI water and silver - lead.

(B) Distribution law : Nernst's Distribution law : its explanation and limitations, Henry's law, extraction and multistep extraction, Numerical problems on Distribution law and extraction.

UNIT - II

(A) Electrochemistry : conductance of electrolytes and its measurement, clasification of electrolytes Transport number, Konlrausch's law and its applications conductometric and potentionmetric titrations. Galvenic cells, reversible and irreversible cells, Polarisation and decomposition potential and over voltage.

(B) Ionic equilibria : Ostwald's Distribution law and its limitations. Debye Heich theory of strong

13/20

electrolytes and degree of ionisation, common ion effect and solubility product : their applications numericals on solubility product.

UNIT- III

(A) Adsorption : Introduction, Physical and chemi-sorption, their comparisons, freundeich and langmuir Adsorption Isotherms, Application of Adsorption, Ion-exchange Adsorption.

(B) Crystal Chemistry : Introduction, crystal gnisatropy space lattice, lattice sites and co-ordination number, types of crystal, Defects in crystals, polymorphism and Isomorphism.

UNIT- IV

Review of the concept of hydrocarbon, valance of carbon atom, unsaturation in carbon compounds, Empirical, mole - cular and structural formula, classification of organic compounds Homologous series IPLIAC system of nomenclature, Isomerism, chain, functional and positional isomerism, types of organic reactions.

UNIT - V

Lab preparation, properties and uses of the following organic compounds, Chloroform, Carbon tetrachlorids, Grignard reagent, Oxialic acid, Acetone, Benzene, Ethylamine, Diazonium salt, and phenol.

EXPERIMENTS :

1. Toverity adsorption isotherm.
2. To determine partition coeffecient.
3. To find the equilibrium constant for the reaction $KI + I_2 - KI_3$
4. Furification of common salt.
5. Conductiometric titration.
6. Potentiometric Titration.
7. Estimation of Nitrogen, Sulphur and Halogen in organic compound.
8. Identification of halogen, nitro, amino carboxylic, aldehyde and ketonic group in orgnic compounds.
9. Laboratory Preparation of orgnic compounds appeared in unit V.

TEXT/REFERENCE BOOK

1. Essentials of physical chemistry by B.S. Bahl and G.D. Tuli.
2. Physical chemistry by N. Kkundu and S.K. Jain.
3. Chapters in physical chemistry by B.N. Phadke.
4. A Text book of physical chemistry by K.K. Sharma and L.K. Sharma.
5. Physics & Chemistry - Dr. S.K. Vadhaya
6. Physical Chemistry - Dr. G.L. Agrawal & Other.
7. Organic Chemistry by Bahl and G.D. Tuli.



13/22

:: MANUFACTURING PROCESSES AND PRACTICE ::

RATIONALE:

Manufacturing Processes (alternatively as fabrication technology) which are so fundamental to an engineering are fast developing with technological ramifications. The subject has the objective of enhancing the theoretical knowledge and practical skills on a base provided by workshop practice. The topics relevant to any fabrication job ; Viz metal casting, Mechanical working, metal joining and machining are included in this chapter.

UNIT-I

Metal Casting :

Pattern making : Different types of pattern material, types, allowances, cores and core prints, moulding, moulding sand and its composition : types and properties, different moulding processes like green sand moulding, dry sand moulding etc. special moulding processes.

Casting Processes : Pouring equipment, metal casting defects.

UNIT- II

Metal working : Hot working and cold working recrystallization temp. types of hot and cold processes i.e. rolling, spinning, extrusion, forging, drawing etc. simple press units and its parts, press working operations.

UNIT - III

13/23

Metal machining: fundamentals of different machining processes, Lath machine: general descriptions and operations like turning, threading, grooving, boring etc. Drilling machines: different parts, types and operations like drilling, reaming etc.

UNIT - IV

Metal joining: types of welding processes plastic welding, fusion welding, resistance welding, arc welding, gas welding, welding equipments and tools, types of weld, types of electrode, weldability of metals, other joining techniques, soldering and brazing.

UNIT - V

Powder metallurgy: Introduction, scope, powder making, compacting, sintering, limitations.

EXPERIMENTS :

1. To prepare a solid pattern.
2. To prepare a core box.
3. Practice of making green sand moulding.
4. Pairing of the mould with suitable material e.g. cast iron, aluminium etc. press and searching for different defects.
5. Practice of making a washer on fly press.
6. Practice of making chisel in smithy shop.
7. Practice of making corner joint and T joint in a welding shop.

8. Practice of spot welding on sheets.
9. Practice of gas welding, making a butt joint.
10. Practice of brazing.
11. Practice of plain turning, step turning, grooving and boring.
12. Practice of knurling and threading.
13. Practice of making drill on flat pieces.
14. Shaping of a rectangular job.
15. Practice of sawing, filling and fitting of small rectangular pieces, preparation of edges for welding.
16. Practice of piercing, notching, and circle cutting with the help of a metal master, machine.

TEXT/REFERENCE BOOKS :

1. Workshop Technology vol. I & II by - Hazra Choudhary.
2. Workshop Technology Vol. I & II by - Raghuvanshi.
3. Manufacturing science and Technology vol. I & II by Suresh Balela.
4. Welding Technology Vol. I by Hazra Choudhary.
5. Foundry practice, Asia publication.
6. Workshop Technology Vol. I & II by Chapman.
7. Mechanical Technology by Charnote.
8. Forging and forming by Russi and Noff.

#####

:: EQUIPMENT DRAWING ::

RATIONALE :-

This is a core subject and designed with a view to developing in the students the drawing and drafting skill and ability of spatial visualization of the engineering components, process equipments and their parts they are to deal with in a practical-situation. This may help them to understand the working of the equipment and its design implications better and to enable them to take up fabrication jobs if necessary.

UNIT - I

Review of orthographic projections, multiview drawing principles and selection of view to describe object, simple problems.

UNIT - II

Sectional views: Necessity of sectioning, representation types of sectional views such as half and full sectional view problems on sectioning.

UNIT - III

Pipes and pipe joints : Types and symbols of pipe fittings such as elbow, tee bend, union, crosses nipples, flange, plug etc. as per I.S. code requirements pipe joints.

UNIT - IV

Fastening : Nuts, Bolts, Keys, Rivets, and Riveted joint, welded joints, cotter joint, pin joint, knuckle joint.

UNIT - V

Assembly drawing : Glands, stuffing box and flange coupling.

TEXT/REFERENCE :

BOOKS :

1. Machine Drawing, by N.D. Bhatt.
2. Machine Drawing : N.Sidheswar and Shagtry.

#####

13/27

:: MECHANICAL OPERATIONS IN CHEMICAL ENGINEERING ::

RATIONALE:

This is one of the four papers designed to deal with the Chemical Engg. core subjects which forms the very basis of the engineering of Chemical Manufacture. The entire Chemical Engg. operations (which are technically known as unit operations, common to all chemical processes) are to be covered in four papers.

The above titled paper covers the topics on mechanical separation, conveying, size reduction mixing and storage of solids. Three other papers are to be taught in the subsequent year.

UNIT- I

Particulate Solids :

Properties of particulate solids. Evaluation of size, surface and population of particles. Standard screens and screen analysis. Industrial screening equipments. Storage of solids.

UNIT - II

Size reduction :

Reduction equipments and their operations. Crushers, grinder and disintegrators. Close and open-circuits and dry and wet operations. Power requirement in comminution-Laws of comminution Rittinger's Kick's and Bond's laws.

UNIT - III

Mechanical Separations :

Flow of solid particles through fluids the concept of terminal settling velocity and stoke's law. Free settling and hindered settling (Mathematical treatment of hindered settling is not required). Settlers, classifiers, jigs. Batch and continuous thickeners and calculation of thickener area. Gravity and centrifugal decanters. Cyclones, electrostatic and magnetic separators. Elementary principles of constant rate and constant pressure filtration. Filtration equipments plate and frame (wash and non-wash) filter-press, rotary drum, leaf-filters and centrifugal filters.

UNIT - IV

Mixing and Agitation :

Fundamentals of mixing, Mixing equipments for solid-solid, solid-liquid and liquid-liquid systems. Flow patterns in agitated vessels. Mixer effectiveness and mixing index.

UNIT - V

Transportation and handling of solids :

Mechanical and pneumatic conveying devices-belt, chain and screw conveyors, elevators and pneumatic conveyors.

EXPERIMENTS

13/29

1. Sieve analysis - to determine the size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter therefrom.
2. Industrial screening - to evaluate the overall effectiveness of a given screening equipment.
3. Power requirement in size reduction - to evaluate the Rittinger's constant in respect of the laboratory ball mill and jaw crusher.
4. Particle size distribution in comminuted products - to study the particle size distribution in ball mill products when (i) the run time and (ii) the material to void ratio change.
5. Surface creation in comminution - to evaluate the Rittinger's number of a given sample of particulate solid.
6. Mixing of solids - to determine the degree of mixing of a given binary solid system in a tumbler mixer.
7. Energy consideration in ball mill operations - to study the load-power and speed-power relationship in respect of a ball mill.
8. Particle mechanics - motion of particles through fluids - to determine the particle size distribution in a mass of fine solids (belonging to sub-sieve region) by the methods of decantation.

9. Batch settling test - to study the settling characteristics of a given slurry.
10. Constant pressure cake filtration - to find the mean specific cake resistance in cake filtration using a single leaf-filter.

TEXT/REFERENCE BOOKS :

1. Unit operations of Chemical Engg. by McCabe Smith.
2. Introduction to Chemical Engg. by Badger and Benchro.
3. Chemical Engg. Vol. II by Richardson and Coulson.



RATIONALE:

This subject relevant to the title of the subject is meant to deal with the manufacture of Chemicals to be taught in two parts under paper-I and paper-II the latter having been placed in the final year curriculum paper-I which is to be taught this year covers the manufacture of inorganic Chemicals. This industries have been chosen as these are the most common industries spread every where.

CONTENT :

Study of the following industries covering properties and uses of the product, manufacturing process, chemical reactions, flow sheet, main fetures of the process and the product, major engineering problems and economics.

UNIT - I

(A) Unitoperations and unit processes, sche- matic representation of various unit operation and unit processes.

(B) Sulfur Industry; Mining and purification of sulfur, sulfuric acid.

(C) Lime and cement.

UNIT - II

Chloro-Alkali Industries; Soda ash, caustic soda sodium carbonate, chlorine, Hydrochloric acid and bleaching powder.

UNIT - III

13/32

- (A) Nitrogen Industries : Amonia, Nittic acid urea and mixed fertilizers.
- (B) Industrial gases : Hydrogen, Oxygen, Producer gas, water gas, carburated water gas, acetylene gas.

UNIT - IV

~~Phosphorous~~ Industries : Phosphorous, Phosphonic acid super phospate, triple superphcasphate.

UNIT - V

Paint and varnishes : Defintion and difference between paint, varnish and laquors. White lead, Titanium dioxide, Zinc oxide, Lithophone, lead chromate, copper sulphate, Iron oxide.

EXPERIMENTS :

1. Purity test of Hcl, HNo3 and H2SO4 acids.
2. Elemental analysis of cement.
3. Ignition loss of limestone.
4. Manufacture of paint.
5. Manufacture of bleaching powder.
6. Nitrogan determination of fertilizer by Kzaldal method.

TEXT/REFERENCE BOOKS :

1. Chemical process Technology.
Vol. I by Shukla and Pandey.
2. outlines of chemical Technology edited by dryden.
3. Chemical process Industries - shreve.

13/33

:: MATERIAL TECHNOLOGY ::

RATIONALE :

This is one of the important subjects of chemical Engg. which deals with the properties and behaviour of the material to be used in process industries as materials of construction for equipments etc. This subject also deals with the various types of deteriorating effects the Chemicals on different material of construction and the selection of best possible material of construction for handling a particular Chemical.

UNIT - I.

Properties and behaviour of materials useful in structures machines and equipments cooling curve for pure iron, Iron-Carbon equilibrium diagram, Micro-constituents of steel and cast iron.

UNIT - II

Corrosion : Corrosion, mechanism of corrosion
Types of corrosion, factors influencing the corrosion,
methods of corrosion control.

Study of the following materials of construction with reference to application in chemical industries.

UNIT - III

Non ferrous materials and alloys; Aluminium, copper, Nickel, plumbum and monal metal.

UNIT - IV

12/31

Ferrous materials: Steel, cast iron, stainless steel, alloy steel.

UNIT - V

Non-metallic materials: Karbate, Wood, Chemical stoneware, Glass, Graphite, plastic, Rubber, ceramic materials.

EXPERIMENTS : -

1. Hardness test of metals.
2. Compressive strength test of metals.
3. Tensile strength test of metals.
4. Tonghness test of metals.
5. Impact test of metals.
6. Identification of materials.

TEXT/REFERENCE :

BOOKS :

1. Materials Science by B.S.Narang.
2. Material Science by R.B.Gupta.
3. Material of construction for Chemical process industries by Z.Z.Lee.
4. Chemical Engg. Materials by Frante Runford.

MEMBERS TOOK PART IN SECOND YEAR CHEMICAL ENGINEERING CURRICULUM REVISION WORKSHOP.

1. Shri S.K. Jain, Principal Co-ordinator
Govt. Polytechnic, Ujjain.
2. Shri M.S. Thakur, HOD Co-ordinator
Govt. Polytechnic, Ujjain.
3. Shri P.K. Gaur, Manager Expert
Shree Syn.Ltd., Ujjain.
4. Shri H.K. Mehta, Industrialist ,,
National Textiles, Ujjain.
5. Shri J.K. Shrivastava, Reader ,,
Govt. Engg. College, Ujjain.
6. Shri J.K. Behera, Retd.Lect. Participant
Govt. Polytechnic, Ujjain.
7. Shri S. Danej, Research Officer,,
M.P. Board of Tech.Education,
Bhopal.
8. Shri Ashok Sharma, Lect. ,,
Govt. Engg. College, Ujjain.
9. Smt. Sarita Sharma, Lect. ,,
Govt.Engg.College, Ujjain.
10. Shri Abhay Kanzarkar, Chem.Engineer ,,
Shree Syn. Ltd., Ujjain.
11. Shri Rajeev Shukla, Chem.Engineer ,,
Shree Syn. Ltd., Ujjain.
12. Shri S.S. Shrivastava, Lect. ,,
Govt.Polytechnic, Ujjain.
13. Shri P.K. Uppal, A.W/s.Suptd. ,,
Govt. Polytechnic, Ujjain.
14. Shri J.K. Jain, Lect. ,,
Govt. Polytechnic, Ujjain.
15. Shri U.K. Soni, Lect. ,,
Govt. Polytechnic, Ujjain.

13/36

16. Smt. S. Mitrasarkar, Lect. Participant
Govt. Polytechnic,
Ujjain.

17. Shri U.C. Giriya, Lect. "
Govt. Polytechnic,
Ujjain.

375

